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10/810,715	03/29/2004	Yuusuke Sato	251072US3RD	9352

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EXAMINER	
LEWIS, BEN	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/810,715	Applicant(s) SATO ET AL.	
	Examiner Ben Lewis	**Art Unit** 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 October 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,7-11,24 and 35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,7-11,24 and 35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. The Applicant's amendment filed on October 27th, 2009 was received. Claims 1 and 35 were amended. Claims 2-6, 12-23 and 25-34 were cancelled.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (issued on May 27th, 2009).

Claim Rejections - 35 USC § 103

3. Claims 1, 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Pan et al. et al. (U.S. Pub. No. 2004/0110046 A1).

With respect to claims 1 and 25, Okamoto disclose a fuel cell power plant (title) wherein the fuel cell power plant is provided with a water tank **1** and a methanol tank **2** "fuel tank", a vaporizer **5** which vaporizes the water and methanol, a reformer **6** which generates reformate gas from the gaseous mixture of water vapor and methanol vapor, and a carbon monoxide oxidizer **7** which removes carbon monoxide (CO) from the reformate gas (Paragraph 0022). A reformer **6** generates hydrogen rich gas from vaporized methanol and a fuel cell stack **8** generates electric power by a reaction of hydrogen rich gas (See Abstract).

Okamoto does not specifically mention wherein the fuel includes dimethyl ether. However, Muller et al. disclose a direct dimethyl ether fuel cell (title) wherein in a direct

dimethyl ether fuel cell, a fuel stream comprising dimethyl ether is supplied directly to the fuel cell anode for direct oxidation therein. Thus, a direct dimethyl ether fuel cell system comprises a system for supplying a dimethyl ether fuel stream to the anode. The fuel stream may contain other reactants and may desirably be supplied as a liquid. For instance, water is a reactant and the fuel stream may be an aqueous solution of dimethyl ether (Col 3 lines 38-55). Muller et al. also teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a

prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, “that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.”)

Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10wt% methanol. However, Pan et al. disclose a fuel delivery system (title) wherein the optimal range of the fuel concentration is determined based on the type of the fuel cell and the intended usage of the fuel cell. For example, the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover. However, if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5%-10% by weight (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al. teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover (Paragraph 0032).

With respect to wherein the fuel includes dimethyl ether water and methanol, the disclosure Okamoto et al as modified by Muller et al. and Pan et al. differs from Applicant’s claims in that Okamoto et al. as modified by Muller et al. and Pan et al. do not disclose wherein the mixing ratio of dimethyl ether and water is in a range of 1:3 and 1:4. However, Muller et al. recognize the need to increase the concentration of dimethyl

ether in a dimethyl ether, methanol and water mixture. Muller et al. teach that If methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). . Therefore, it would have been within the skill of the ordinary artisan to adjust the DME/ water ratio in the methanol/DME/ water mixture of Okamoto et al. as modified by Muller et al. and Pan et al. such that the DME/water ratio is within the applicants claimed DME/water ratio range in order to obtain higher efficiency during low fuel cell loads. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215.

With respect to claim 11, Okamoto teach that the Specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025). Regarding shift catalyst, Okamoto teach that the carbon monoxide oxidizer 7 performs catalytic combustion due to the preferential oxidation of the carbon monoxide in the reformate gas to generate hydrogen-rich gas with a low level of carbon monoxide, using noble metal catalysts such as ruthenium (Ru) and platinum (Pt) (Paragraph 0026).

With respect to claim 24, Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during

low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, “that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.”)

4. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Yonestu et al. (U.S. Patent No. 6,506,513 B1).

With respect to claim 7, Okamoto as modified by Muller et al. disclose a fuel cell in paragraph 3 above. Okamoto as modified by Muller et al. do not specifically mention wherein the tank comprises a cartridge unit, a valve unit, a holding unit and a supplying unit. However, Yonestu et al. disclose a liquid fuel-housing tank for fuel cell (title) Yonsetu et al. teaches a fuel tank **1** “cartridge”, a valve **23**, a connecting section **33**

“holding member” and a pathway **3** “supply unit” (Col 10 lines 40-67) (See Figs 10A, 11A and 12). Yonsetu et al. also teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body. In other words, it is required that the fuel tank has a mechanism for promptly supplying the fuel in the initial period (Col 2 lines 10-25). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fuel tank of Yonsetu et al. into the fuel cell system of Okamoto as modified by Muller et al. because Yonsetu et al. teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body (Col 2 lines 10-25).

With respect to claim 8, Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67).

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Suzuki et al. (U.S. Pub. No. 2002/0068206A1).

With respect to claim 9, Okamoto as modified by Muller et al. disclose a fuel cell system in paragraph 3 above. Okamoto as modified by Muller et al. do not specifically mention a vacuum heat insulation container containing the combustor, containing the vaporizer, the reformer and the CO gas removal apparatus. However, Suzuki et al. discloses a fuel cell power system wherein the first hydrogen storage vessel 11, the catalytic combustor 17 and the first three way valve 15 are housed within a thermal insulation housing 25 having a vacuum insulation structure. The thermal insulation housing 25 prevents the combustion heat generated by the catalytic combustor 17 from diffusing outside the system and maintains the temperature of the first hydrogen storage vessel 11 at about 250 ^{o}C to about 280 ^{o}C (Paragraph 0019). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the vacuum heat insulation housing of Suzuki et al. to contain the combustor, vaporizer, reformer and CO gas removal apparatus of Okamoto as modified by Muller et al. because Suzuki et al. teach that the thermal insulating housing maintains the temperature of the system components within the housing (Paragraph 0019).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view Kaneko et al. (U.S. Pub. No. 2001/0021469 A1).

With respect to claim 10, Okamoto as modified by Muller et al. disclose a fuel cell system in paragraph 3 above. Okamoto teach that, specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025).

Okamoto as modified by Muller et al. do not specifically mention a reforming catalyst of an alumina and at least one material selected from the group consisting of Rh, Pd, Pt and Cu. However, Kaneko et al. disclose a methanol reforming catalyst wherein, the methanol reforming catalyst may contain other component except the catalytic compound. For example, in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may be used (Paragraph 0038). Kaneko et al. also teach that Pd component is alloyed with Zn, generation of CO due to the above methanol decomposition reaction expressed by following Eq. (f2) can be suppressed while holding the high temperature stability (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the alumina and palladium of Kaneko et al. as reforming catalyst in the reformer of Okamoto as modified by Muller et al. because Kaneko et al. teach that in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound,

may be used (Paragraph 0038) and methanol decomposition can be suppressed using Pd/Zn catalyst (Paragraph 0032).

7. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1), Pan et al. et al. (U.S. Pub. No. 2004/0110046 A1), Yonestu et al. (U.S. Patent No. 6,506,513 B1), Kaneko et al. (U.S. Pub. No. 2001/0021469 A1) and Suzuki et al. (U.S. Pub. No. 2002/0068206A1).

With respect to claim 35, Okamoto disclose a fuel cell power plant (title) wherein the fuel cell power plant is provided with a water tank **1** and a methanol tank **2** “fuel tank”, a vaporizer **5** which vaporizes the water and methanol, a reformer **6** which generates reformate gas from the gaseous mixture of water vapor and methanol vapor, and a carbon monoxide oxidizer **7** which removes carbon monoxide (CO) from the reformate gas (Paragraph 0022). A reformer **6** generates hydrogen rich gas from vaporized methanol and a fuel cell stack **8** generates electric power by a reaction of hydrogen rich gas (See Abstract).

Okamoto does not specifically mention wherein the fuel includes dimethyl ether. However, Muller et al. disclose a direct dimethyl ether fuel cell (title) wherein in a direct dimethyl ether fuel cell, a fuel stream comprising dimethyl ether is supplied directly to the fuel cell anode for direct oxidation therein. Thus, a direct dimethyl ether fuel cell system comprises a system for supplying a dimethyl ether fuel stream to the anode.

The fuel stream may contain other reactants and may desirably be supplied as a liquid. For instance, water is a reactant and the fuel stream may be an aqueous solution of dimethyl ether (Col 3 lines 38-55). Muller et al. also teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding,

among other reasons, “that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.”)

Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10wt% methanol. However, Pan et al. disclose a fuel delivery system (title) wherein the optimal range of the fuel concentration is determined based on the type of the fuel cell and the intended usage of the fuel cell. For example, the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover. However, if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5%-10% by weight (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al. teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover (Paragraph 0032).

With respect to wherein the fuel includes dimethyl ether water and methanol, the disclosure Okamoto et al as modified by Muller et al. and Pan et al. differs from Applicant’s claims in that Okamoto et al. as modified by Muller et al. and Pan et al. do not disclose wherein the mixing ratio of dimethyl ether and water is in a range of 1:3 and 1:4. However, Muller et al. recognize the need to increase the concentration of dimethyl ether in a dimethyl ether, methanol and water mixture. Muller et al. teach that If methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5

lines 60-67). . Therefore, it would have been within the skill of the ordinary artisan to adjust the DME/ water ratio in the methanol/DME/ water mixture of Okamoto et al. as modified by Muller et al. and Pan et al. such that the DME/water ratio is within the applicants claimed DME/water ratio range in order to obtain higher efficiency during low fuel cell loads. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215.

Okamoto as modified by Muller et al. and Pan et al. do not specifically mention wherein the tank comprises a cartridge unit, a valve unit, a holding unit and a supplying unit. However, Yonestu et al. disclose a liquid fuel-housing tank for fuel cell (title) Yonsetu et al. teaches a fuel tank **1** "cartridge", a valve **23**, a connecting section **33** "holding member" and a pathway **3** "supply unit" (Col 10 lines 40-67) (See Figs 10A, 11A and 12). Yonsetu et al. also teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body. In other words, it is required that the fuel tank has a mechanism for promptly supplying the fuel in the initial period (Col 2 lines 10-25). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fuel tank of Yonsetu et al. into the fuel cell system of Okamoto as modified by Muller et al. and Pan et al.. because Yonsetu et al. teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial

rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body (Col 2 lines 10-25).

Okamoto teach that, specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025).

Okamoto as modified by Muller et al., Pan et al. and Yonsetu et al. do not specifically mention a reforming catalyst of an alumina and at least one material selected from the group consisting of Rh, Pd, Pt and Cu. However, Kaneko et al. disclose a methanol reforming catalyst wherein, the methanol reforming catalyst may contain other component except the catalytic compound. For example, in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may be used (Paragraph 0038). Kaneko et al. also teach that Pd component is alloyed with Zn, generation of CO due to the above methanol decomposition reaction expressed by following Eq. (f2) can be suppressed while holding the high temperature stability (Paragraph 0032).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the alumina and palladium of Kaneko et al. as reforming catalyst in the reformer of Okamoto as modified by Muller et al., Pan et al. and Yonsetu et al. because Kaneko et al. teach that in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may be used (Paragraph

0038) and methanol decomposition can be suppressed using Pd/Zn catalyst (Paragraph 0032).

Okamoto as modified by Muller et al., Pan et al., Yonsetu et al. and Kaneko et al. do not specifically mention a vacuum heat insulation container containing the combustor, containing the vaporizer, the reformer and the CO gas removal apparatus. However, Suzuki et al. discloses a fuel cell power system wherein the first hydrogen storage vessel 11, the catalytic combustor 17 and the first three way valve 15 are housed within a thermal insulation housing 25 having a vacuum insulation structure. The thermal insulation housing 25 prevents the combustion heat generated by the catalytic combustor 17 from diffusing outside the system and maintains the temperature of the first hydrogen storage vessel 11 at about 250 ^{o}C to about 280 ^{o}C (Paragraph 0019).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the vacuum heat insulation housing of Suzuki et al. to contain the combustor, vaporizer, reformer and CO gas removal apparatus of Okamoto as modified by Muller et al., Pan et al., Yonsetu et al. and Kaneko et al because Suzuki et al. teach that the thermal insulating housing maintains the temperature of the system components within the housing (Paragraph 0019).

Response to Arguments

8. Applicant's arguments filed on October 27th, 2009 have been fully considered but they are not persuasive.

Applicant's principal arguments are

(a) First, the claims here include a single fuel tank storing the fuel of DME, water, and methanol. The two primary references relied upon in the rejections have two tanks separating water from methanol (see Okamoto FIG. 1 lower left portion, water tank 1 and methanol tank 2 and FIG. 1B of Pan, Fuel Tank 102 and water tank 110). Thus, the references relied upon in the rejection teach away from that which is claimed.

(b) Applicants have provided data demonstrating the importance of 5 to 10 % of methanol to achieve the balance between dissolubility of water in the fuel while maintaining high energy density production, all being combined in a single fuel tank.

(c) Mr. Sato, in the attached Declaration again explains the importance of the claimed concentration range of 5-10 wt% of MeOH. He calculated the "S/C ratio" of the present invention and Pan's disclosure, based on the data represented in the declaration submitted on October 30, 2009.

The methanol range between the claimed fuel and Pan's fuel is seemingly similar because both of claimed fuel and Pan's fuel disclose 5-10% of methanol.

However, as understood from the above calculation results, Pan's fuel is completely different fuel from claimed fuel because the amounts of the S/C ratio are significantly different from each other. (Sato Declaration at para. 15)

(d) While Applicants understand that the Examiner contends that if the fuel cell is to be used in an application that requires high power out put, the optimal range of fuel concentration may become 5-10% by weight. However, applicant consider that Pan could not be incorporated to the fuel system of Okamoto because with regard to fuel efficiency, the principle of the DMFC as disclosed in Pan and the principle of RHFC as disclosed in claimed system are completely different. (Sato Declaration at para. 17)

(e) Muller et al's fuel cell type is DMFC. DMFC is different from the claimed reformed hydrogen fuel cell system (RHFC). As discussed in the previously submitted declaration, the S/C ratio of DMFC and the claimed invention (RHFC) are also completely different with each other. Also, DMFC and RHFC are not structurally similar. One of ordinary skill in the art would not recognize how the composition of the fuel in the claims (i.e. the mixing ratio of DME and water) contributes to the claimed RHFC system based on the disclosure of an DMFC system. Additionally, Muller et al, do not provide any evidence or examples regarding the applicability of DMFC against RHFC.

In response to Applicant's arguments, please consider the following comments.

(a) Examiner notes that: Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, "that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.")

With respect to prevention of mixture separation. Examiner notes that Applicant has not claimed this feature or any device that prevents mixture separation.

(b) Examiner notes that: Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10wt% methanol. However, Pan et al. disclose a fuel delivery system (title) wherein the optimal range of the fuel concentration is determined based on the type of the fuel cell and the intended usage of the fuel cell. For example, the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover. However, if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5%-10% by weight (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al. teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover (Paragraph 0032).

(Examiner note that Pan et al. Also teach that if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5%-10% by weight (Paragraph 0032))

(Examiner notes that the properties of solubility are inherent for the methanol concentrations of Pan since the methanol concentration of Pan is within the claimed range of Applicant).

(c) and (e) In response to applicant's argument that "*Pan's fuel is completely different fuel from claimed fuel because the amounts of the S/C ratio are significantly different*

from each other", Exaiminer notes that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Examiner notes that the Pan reference was relied upon to show that it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al. teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover.

(d) Okamoto does not specifically mention wherein the fuel includes dimethyl ether. However, Muller et al. disclose a direct dimethyl ether fuel cell (title) wherein in a direct dimethyl ether fuel cell, a fuel stream comprising dimethyl ether is supplied directly to the fuel cell anode for direct oxidation therein. Thus, a direct dimethyl ether fuel cell system comprises a system for supplying a dimethyl ether fuel stream to the anode. The fuel stream may contain other reactants and may desirably be supplied as a liquid. For instance, water is a reactant and the fuel stream may be an aqueous solution of dimethyl ether (Col 3 lines 38-55). Muller et al. also teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over

direct methanol fuel cells (Col 4 lines 7-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ben Lewis/
Examiner, Art Unit 1795

/PATRICK RYAN/
Supervisory Patent Examiner, Art Unit 1795